Available online at www.sciencedirect.com

ScienceDirect

Procedia Economics and Finance 18 (2014) 271 – 278

Procedia Economics and Finance

www.elsevier.com/locate/procedia

4th International Conference on Building Resilience, Building Resilience 2014, 8-10 September 2014, Salford Quays, United kingdom

Awareness, perception and communication of earthquake risk in Portugal: Public survey

Romeu Vicente[a*], Tiago Miguel Ferreira[a], Rui Maio[a], Herbert Koch[b]

[a]*University of Aveiro, Campus Universitário de Santiago, Aveiro, 3810-193, Portugal*
[b]*International Association of Risk and Crisis Communication, Rue Leschot 2, Genève, CH-1205, Switzerland*

Abstract

Risks are associated to dangerous events that have an estimable probability of occurring and some potentially severe consequences. A risk is the potential to cause crisis, an emergency, a disaster and/or a catastrophe. The definition of risk acceptability is not technical but value driven. This definition is determined at two levels: at the individual level and at the state level. Every citizen decides what kind of risk he is willing to take in his daily life (his choice of transportation, his choice to smoke or to drink alcohol, etc.). The government, on the other side, is setting risk acceptability limits on a societal level (example: speed limits, laws regulating construction areas and density, etc.). The historical experience of a society will affect the way that it view risks and crisis. This article deals with seismic risk perception and communication in Portugal. A survey carried out resourcing to a questionnaire was developed to assess the knowledge on seismic risk perception and awareness in the Algarve region. Two questionnaires were developed: i) General Public, ii) Professional and Technical (engineers and architects). Results were treated statistically and thoroughly analysed and commented. Risk communication can influence communities to become aware of risks and it has a powerful influence on people's risk decision-making and behaviour. Risk communication has several objectives. It has the role to prevent risks, to reduce them and to make communities aware of the risks in order to develop their capacities, enhance communication and resilience to respond to crisis events.

Selection and/or peer-reviewed under responsibility of the Centre for Disaster Resilience, School of the Built Environment, University of Salford.

Keywords: Risk communication; awareness ; perception; questionnaire; survey.

* *Corresponding author. Tel.: +351-234-370-845; fax: +251- 234-370-094.*
E-mail address: romvic@ua.pt.

Selection and/or peer-reviewed under responsibility of the Centre for Disaster Resilience, School of the Built Environment, University of Salford.
doi:10.1016/S2212-5671(14)00940-X

Nomenclature

n	number
yr	years

1. Earthquake risk awareness and perception in Portugal

1.1. Earthquake risk awareness in Portugal

In societies that have experience of natural or manmade disasters it is easier to increase awareness, preparedness and management and develop risk and crisis communication strategies (Kung and Chen, 2012). In societies with little experience of disasters it is more difficult to convince people of the need for effective measures regarding awareness, management and communication.

The last major earthquake in Portugal dates back to the year 1755, known as the Great Lisbon Earthquake, the undersea earthquake of November 1, had its epicenter in the Atlantic Ocean about 200 km west-southwest of Cape St. Vincent and an estimated magnitude in the range 8.5-9.0 in the Richter scale. This earthquake is still the biggest event of its kind in European history. It was followed by enormous tsunamis (5-10 meters waves) and consequent fires, which raged for several days. The earthquake almost totally destroyed Lisbon. It seriously affected the southern coastline, including the Algarve region. With a death toll estimated between 10,000 and 100,000, it is described as one of the deadliest earthquakes in history. With an estimated financial loss of between 32% and 48% of Portugal's gross national product, it is also the greatest financial disaster to have affected Western Europe. Whereas seismic activity on mainland Portugal, especially in the Algarve region, is constant and latent, dramatic earthquakes are limited in number or have taken place very long time ago. Risk awareness is dependent on several factors. Most importantly, a great probability and risk frequency coupled with a strong impact raises the awareness of any particular risk. Even though the earthquake probability and frequency in Portugal could be considered high, the vast majority of the earthquakes are of minor magnitude, below 5.0 on the Richter scale. The absence of a dramatic earthquake on mainland Portugal for a long time might contribute to the low seismic risk preparedness among the general public in Portugal. However, not totally true for the Azores, where earthquakes are more frequent, stronger (above magnitude 5.0 of the Richter scale) and cause severe casualties on a regular basis.

1.2. The URBSIS project

In August 2010, the Portuguese Parliament adopted a resolution with the aim to reduce seismic risk. The resolution stated the necessity to promote scientific research in the field of seismic risk prevention, earthquake engineering and seismology and to draw up a national plan to reduce seismic vulnerability. It also stated the importance of stimulating collaboration between local municipalities with the support of the government and the scientific and technical community by drawing seismic risk maps for historical city centres that identify the most vulnerable building typologies. These maps are useful for defining management strategies and emergency planning at urban scale and allow the socioeconomic evaluation of the consequences of seismic events. In many urban areas of southern European countries, as in the case of Portugal, the majority of the masonry building stock lacks adequate seismic resistance. Most of these buildings generally require urgent retrofitting interventions in order to reduce their seismic vulnerability and physical risk, particularly for the increased seismic action requirements of recent European code standards.

In the context of the resolution, the University of Aveiro (UA) and the Instituto Superior Técnico (IST) lead and coordinate a project for "Assessing Vulnerability and Managing Earthquake Risk at the Urban Scale – URBSIS". Three historical city centres, Aveiro (with 521 buildings), Faro (809 buildings) on the mainland and Horta (443 buildings), on the island of Faial island in the Azores, were selected for the study. With a first vulnerability and risk assessment starting in the city of Faro in January 2014, the URBSIS project will last until December 2015.

A new and original approach was introduced by adding a risk communication element to the URBSIS project.

Increasingly, professional risk communication is being recognized as essential to enabling people and organizations, including governments, to manage risks and crises effectively.

The Portuguese Association of Risk and Crisis Communication (ARCCP), a national association of the International Association of Risk and Crisis Communication (IARCC), is one of the partners of the URBSIS project. IARCC is a non-governmental, independent and international network of nationally organized associations with headquarters in Geneva, Switzerland. The objectives of the IARCC and its national organizations is the furthering of responsible and professional communication and its recognition is an important step to reduce risks, prevent crisis and catastrophe scenarios or reduce the harm they cause. IARCC and its national associations provide a platform to all stakeholders on any given risk and crisis communication related project. URBSIS will result in technical recommendations that, through the partnership with ARCCP, will be explained to a broader audience and shall in this way generate an increased understanding and acceptance not only by key decision makers but the general public of the communities as well. By adding a communication part to the mission, the scientific team of the University of Aveiro wants to accomplish the following goals: ensure a good cooperation with the population of Faro, Faial and Aveiro and its representatives; make sure that the contents of the audit report of the scientific research team are well understood and that practical actions are taken in accordance with the report findings; improve the risk and crisis communication strategy and emergency planning in case of earthquake; and enhance their overall risk awareness, preparedness and crisis management capabilities.

1.3. The seismic risk communication methodology associated to the URBSIS project

In order to define the most appropriate risk communication plan, careful consideration has to be given to underlying aspects. A fundamental aspect is the clear definition of basic principles and standards with regard to urban planning, architecture and infrastructure. These basic principles and standards must integrate state-of-art knowledge on seismology and seismic engineering, and they must be clear, exhaustive and reasonable. Once the decision makers, the profession as well as the community have become familiar with these fundamentals, the next step is to define, implement and apply rules reflecting these standards and fundamentals.

Level A (see Fig 1) defines “what has to be done” and level B defines “how it should be done”. Once these definitions are clear, the responsible actors can start the communication process and spread the word and inform all stakeholders. This communication process needs a strategy, which defines the aim, the messages, the targets and the tools (level C). The communication strategy will become the foundation of the risk communication plan, which specifies additional elements that allow answering the following crucial questions: “What action and activities shall be carried out?”; “Who is going to be responsible for them?”; “At what date and time will the communication take place?”; “What will be the budget of any given activity?”; and “What will be the criteria of a successful communication campaign?”

Fig. 1. The Pyramid of Communication.

1.4. Earthquake Risk Perception in Portugal

The analysis of seismic risk perception in Portugal is essential in drafting the appropriate seismic risk communication plan. The plan needs to address the prevailing risk perception of the population on the mainland of Portugal as well as on the Azores with regard to seismic hazards.

One of the most important paradoxes in the risk perception literature is that the risks which kill or harm people, and the risks that alarm and upset people, are often very different (Covello, 2010). In other words: there are many risks that make people worry and upset but cause little harm. At the same time, there are risks that kill or harm many people, but do not make people worried or upset. This paradox is explained in part by the factors that affect how risks are perceived (Covello, 2010). They determine a person's emotional response to risk information. Levels of fear, worry, anxiety, anger and outrage tend to be lowest when a risk is perceived to be well understood, relatively well known to science, that produce "statistical victims" and are caused by nature or "Act of God". Example of this, Earthquake risks are rather well understood and are relatively well known to science, they produce "statistical victims" and are caused by nature. All of these factors tend to reduce people's risk awareness with regard to Earthquake risks.

Risk awareness and risk perception is not only dependent on personal risk experience and risk history. Another way to develop risk awareness and shape risk perception is by creating and disseminating information and communication tools and organizing risk awareness campaigns. Portuguese institutions have been active in this field. As an example, the National Civil Protection Authority (ANPC) has organized an event with the objective to raise the preparedness the population in view of seismic risks. The event called "*A terra treme*" on October 11, 2013 was aimed to inform the population how to behave in case of an earthquake.

2. Risk perception: Questionnaire and results

Risk perception is a fundamental issue in the definition and the adoption of preventive measures. In order to develop effective information and risk communication strategies, the perception of risk and the influencing factors should be known. A questionnaire was constructed the scope of a national research project referred in Section 1.2, and the results on seismic risk perception and communication are presented and discussed.

From the data collected and treated, it is revealed that seismic risk perception is strongly misunderstood, and taking into account that the results are from the population that lives in the Algarve region, one of the most dangerous zones of Portugal (Santos et al, 2013), they do not have a correct perception of seismic vulnerability, hazard and risk. From these results it is clear that extreme urgent measures are required in Portugal to reach an effective way to communicate seismic risk.

2.1. Questionnaire

In order to explore risk perception and communication level of the public, a questionnaire to evaluate the public's knowledge, cognition and response to earthquake disaster was carried out. A set of questions on basic knowledge on earthquake activity, building characteristics, how to proceed in the case of an event, who is responsible for coordinating response actions are formulated. The questionnaire was aimed to assess knowledge level on earthquake risk. Two questionnaires were developed, one for the technical community (engineers, architects, decision makers) and another for the general public. In this paper it is only exposed results of the latter.

The questionnaire was carried out by sidewalk interview of residents of the old city centre of Faro, and is now online to expand to a broader number of responded questionnaires at the national level. Fig 2 shows the general layout of the questionnaire.

From a total universe of 430 people, the sample is composed of 135 individuals, of these 72 are male and 63 are female. For both genders, the majority of the individuals have between 25 and 50 years (72.22% and 66.66% for males and females respectively). Concerning the sample's level of education, 79.17% of the males and 90.48% of the females present middle or high education level – corresponding to secondary and higher school, which represents a total of 65 individuals (48.15% of the total sample) with higher level of education.

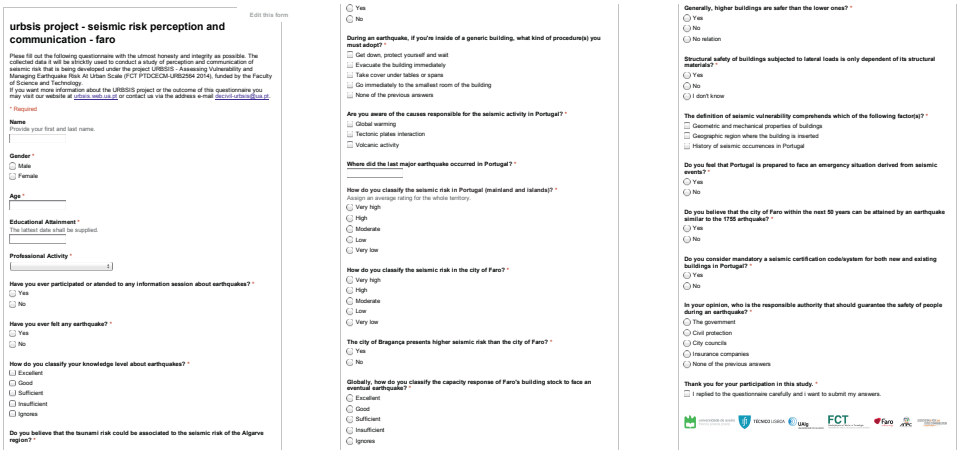

Fig. 2. Overview of the questionnaire - Perception and Communication of Seismic Risk.

2.2. Main results and data interpretation

The main results obtained from the above-presented questionnaire are shown and commented in this section. In order to facilitate their analysis, the results were divided into four groups, each of them graphically treated in the Figures 3 to 6.

The first group of questions (see Fig 3) aims at evaluating the past experience of the population with earthquakes, first inquiring if they have already felt an earthquake, then if they have already participated in any information session on earthquakes and finally how they classify their knowledge level in this field.

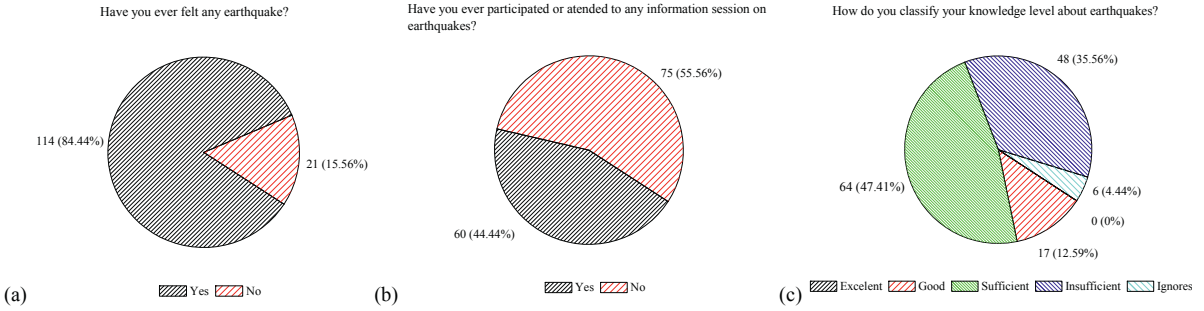

Fig. 3. Population's personal experience and knowledge about earthquakes.

From the analysis of Fig 3 (a), it was possible to observe that the great majority of the inquired inhabitants of Faro (84%) reported having felt an earthquake at least once and only 16% of the participants stated never having felt any earthquake. This is a curious observation since that according to the Portuguese Institute for the Sea and the Atmosphere Institute (IPMA, IP) the Portuguese territory is hit by several earthquakes of low magnitudes, some of these are likely to be felt, almost everyday. Moving on to the second question, herein shown in Fig 3 (b), 56% of the inquired assumed never having participated in information sessions about earthquakes. Such initiatives are fundamental to clarify the inhabitants about general concepts regarding earthquakes and how to behave during and after such an event. Recently, many countries, such as Turkey and Italy, have made prudent investments in seismic risk educational training programs, resulting with the publication of some practical guides (Elgin, 2009). Regarding the third and last question of this first group; besides 56% of the inquired have never attended to any informative session about earthquakes, 13% and 47% of the participants considered themselves with an excellent and good

proficiency knowledge level regarding this matter, respectively. Instead, 36% of the respondents have classified them knowledge level as insufficient or inadequate.

The second group of questions, presented in Fig 4, is dedicated to the analysis of the general knowledge of the population about the seismic activity in Portugal, both about the memory of past earthquakes and their causes, and concerning the seismic risk associated to the city of Faro.

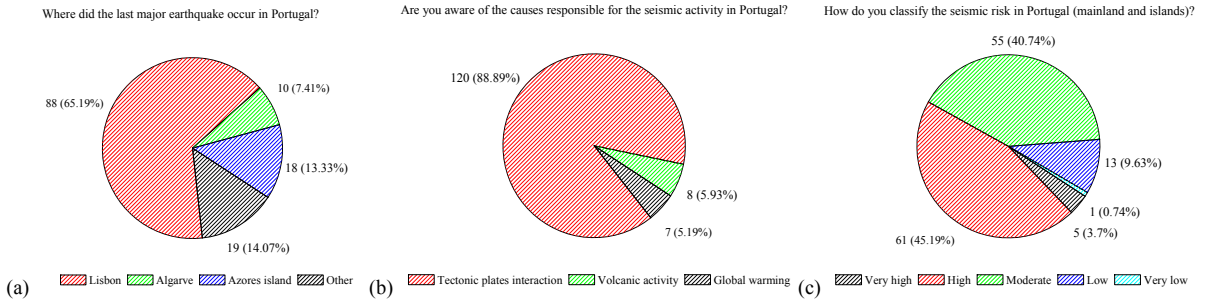

Fig. 4. General knowledge of the population on the seismic activity in Portugal.

The objective of this first question was to evaluate the remembrance of the population in relation to past important seismic events in Portugal, i.e., past earthquakes responsible for causalities and/or significant material losses. Globally, as we're considering all the national territory, the proper answer should have been Azores islands, referring the 1998 earthquake. However, if we are inquiring at a regional level, we should consider correct the answer Algarve, since the 1969 brought severe damages to this region. 65% of the inquired recall the 1755 earthquake as the last and damaging earthquake in Portugal, either by being unaware of later events or by consciously considering this earthquake as the most devastating earthquake ever felt in Portugal and one of the most important earthquakes occurred in Europe. Anyway, further attention should be paid to this fact, which is substantially aggravated by the 11% of inquired who pointed other kind of answers, not plausible to be deemed as correct. Regarding the second question of this group it is worth referring that earthquakes, as a natural disasters, usually happen due to two main different causes which are always associated with an abrupt release of energy: interaction between tectonic plates or volcanic activity. From this sample it is evident that 92% of the inquired associate the seismic activity of the Portuguese territory with the interaction between tectonic plates, while only 3% considers the importance of the volcanic activity as a natural cause for the seismicity prevailing in distinct areas, such as the Azores islands. 5% of the inquired answered incorrectly, considering that the global warming is one of the causes behind the seismic activity in Portugal. The third question was intended to evaluate the inquired opinion about the seismic risk associated to Portugal (mainland and islands). If considered as an isolated outcome, one might think that the majority of the inquired (86%) classify the seismic risk in the Portuguese territory from high to moderate, while only 10% classify it from low to very low. Finally 4% considered the seismic risk in Portugal as very high. Despite the ambiguity inherent to this question, it is worth stressing the apparent consciousness of the great majority of the respondents classifying the seismic risk of the Portuguese territory from moderate to high.

Fig 5 presents the answers to some of the questions formulated to evaluate the inquired opinion about how people and buildings should react, or are ready to respond, during a seismic event. In this sense, and moving on to the question presented in Fig 5 (a), it should be noted that, on the one hand and considering an ordinary building, two answers may be considered correct: “Get down, protect yourself and wait” and “Take cover under tables or door openings”. Together, 58% of the inquired answered correctly. On the other hand, with respect to the incorrect answers, it is important to highlight that 20% of the inquired believe that evacuating the building immediately is the most appropriate decision. Regarding this idea, some of the most destructive past earthquakes have proved that this behavior should be avoided, since the fall of heavy objects or structural and non-structural elements has been responsible for a significant number of fatalities (Ferreira et al, 2014). Globally, 42% of the inquired are unaware of the advisable recommendations to adopt in the event of an earthquake.

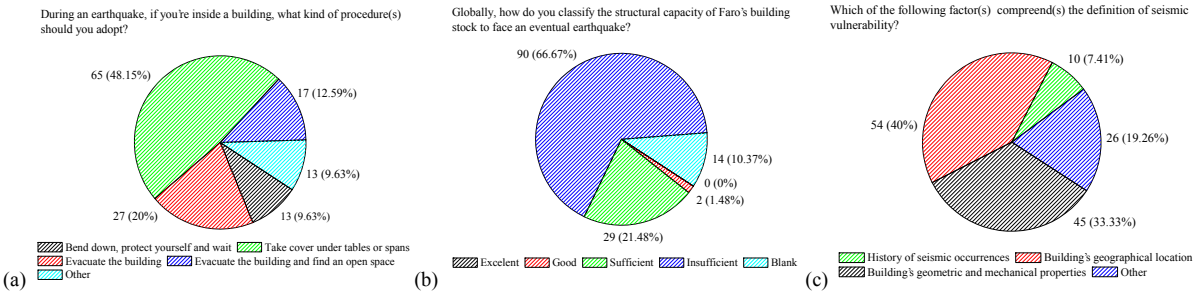

Fig. 5. Adequate behavior to an earthquake: people and buildings.

Concerning the inquired beliefs on the seismic capacity of Faro's building stock to face an eventual earthquake (Fig 5 (b)), the great majority (67%) had no doubt in classifying it as insufficient, relying on the widespread poor conservation state of their own buildings, particularly the old city centres, which undergoes from the broad abandonment and devaluation. Nevertheless, 21% of the inquired believe that, in general, Faro's building stock will be able to withstand an eventual earthquake without significant damage. The inquired who gave such highly positive classification might live in the surrounding districts or villages, but probably are unaware of the old city centre area reality. Finally, 10% of the respondents are unaware of the seismic vulnerability of Faro's building stock, which together with the previous 21% is fairly alarming. The last question of this group intended to assess the knowledge of people about the concept of vulnerability. As is recognized, seismic vulnerability can be described as an inherent property of buildings reflecting the predisposition to suffer damage due to a determined seismic action, which is associated with the physical and structural characteristics of such buildings (Barbat et al, 2010; Ferreira et al, 2013). As can be seen in Fig 5 (c), only 33% of the inquired are aware of the correct definition of seismic vulnerability. The remaining answers were distributed by the impressive 40% of required whom believe that the geographical region where the building is inserted influences the seismic vulnerability of buildings, 8% that considered the history of seismic occurrences in Portugal an influential factor on the seismic vulnerability, and finally, 19% who have considered more than one of these factors, in which at least one of them was incorrect response. Lastly, the fourth group of questions aims at evaluation the people's perception in what regards to the preparation of Portugal to face a seismic situation and about the role of the authorities in such actions, (see Fig 6).

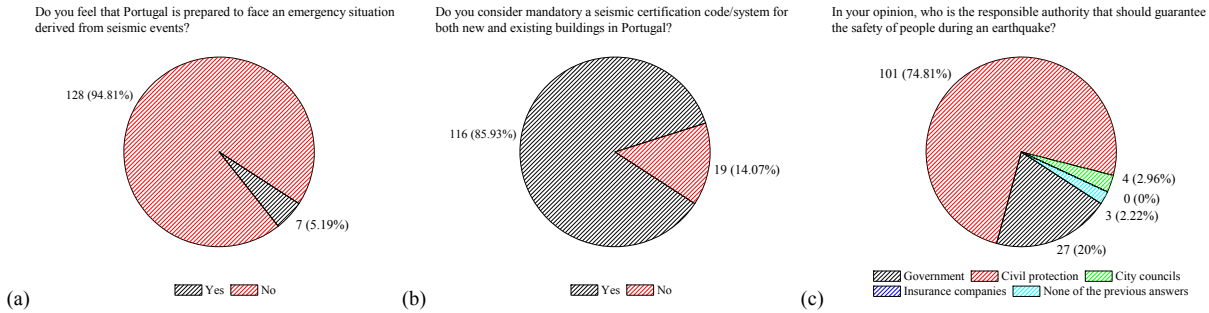

Fig. 6. Portuguese preparedness to face an earthquake crisis.

Although in some previous questions the answers were not significantly overwhelming, when inquired about Portugal's preparedness to face an emergency situation in consequence of a seismic event, 95% don't believe that our country has implemented yet solid and prudent strategies to face the challenge. The non-disclosure or lack of self-promotion by the responsible authorities regarding the planned strategies that have being developed (or to develop...) and slowly implemented and also some political negligence do not help to enhance this massive and negative opinion. Lately, this issue has raised some controversy and enough ink has been used up on the building's seismic certification subject. Several well-known Portuguese experienced researchers have been arguing that one

should know more about their house's seismic resistance. As such, as already implemented for building's and home appliances energy efficiency certification, an equivalent certification system has been proposed by the research community and the Portuguese Society of Seismic Engineering (SPES). This measure, that would be also extremely useful for insurance companies, has been a hotly debated issue, and is at this time waiting for a political settlement. The view of the inquired about this issue is evident, expressed by 86% who considered mandatory a seismic certification system both for new or existing buildings. Finally, 75% of the respondents are aware of who is the responsible authority for the people's safety during the occurrence of an earthquake. Only 20% assigns this responsibility to the government, which is somehow understandable since it is the maximum responsible for national strategy definition. A negligible percentage of 5% were clearly unaware of the actual responsible authority.

3. Final Comments

According to the survey results, it is found that public awareness on seismic risk and mitigation is poor and their knowledge on basic theory and emergency response must be improved. Campaigns of information and education on seismic risk is a national demand, several countries have carried out projects on the national scale: National Earthquake Hazards Reduction Program (NERHP) and the Istanbul Seismic Risk Mitigation and Emergency Preparedness Project (ISMEP) (Santos et al, 2013), both have specific project lines on risk perception, education and communication of risk. Special reference to UNISDR, in the case of the development of the guides “My city is getting ready”, a broader document, but necessary as a basis document to base action and strategy. There is still much to be done by national authorities, supported by a governmental action, on various levels: technical courses for disaster prevention and emergency; education at schools, developing mechanisms and protocols towards natural disasters; education and publicity campaigns at city level for the general public, concerning disaster reduction and knowledge of risks, awareness of disaster prevention and behavior in emergency scenarios. As this study will move to other communities, the contents of questionnaire will be refined and its dissemination improved. Questions shall find out as to whether people have had direct impact from seismic events (personal harm) and open questions will give the inquired possibilities to propose improvements regarding technical, information and training matters. The analysis of all questionnaires at the end of the study shall give precious suggestions of how to produce information and develop seismic risk communication, which is obviously lacking as confirmed at the early stage of this work. It will also enrich the discussion concerning basic principles, technical standards, rules and procedures.

Acknowledgements

The work presented in this paper was supported and funded by the Portuguese Foundation of Science and Technology, FCT, under the project URBSIS – Assessing Vulnerability and Managing Earthquake Risk at Urban Scale, PTDC/ECM-URB/2564/2012, and commissioned by the Faro City Council.

References

Barbat, A. H., Carreño, M. L., Pujades, L. G., Lantada, N., Cardona, O. D., Marulanda, M. C., 2010. Seismic vulnerability and risk evaluation methods for urban areas. A review with application to a pilot area, Struct. Infrastruct. Eng. 6, no. 1-2, p. 17-38.

Covello, V. T., 2010, “Strategies for overcoming challenges to effective risk communication”. Heath, Robert L. & O'Hair, H. Dan: Handbook of Risk and Crisis Communication, p. 143-167.

Elgin, K.G., 2009. “Istanbul Seismic Risk Mitigation and Emergency Preparedness Project (ISMEP)”. Improving the Seismic Performance of Existing Buildings and Other Structures, pp. 1129–1140.

Ferreira, T.M., Vicente, R., Varum, H., 2014. “Seismic vulnerability assessment of masonry façade walls: development, application and validation of a new scoring method”, Structural Engineering and Mechanics, An International Journal, 50, no. 4.

Ferreira, T.M., Vicente, R., Mendes da Silva, J. A. R., Varum, H., Costa, A., 2013. Seismic vulnerability assessment of historical urban centres: case study of the old city centre in Seixal, Portugal, Bull. Earthq. Eng. 11, no. 5, p. 1753-1773.

Kung, Y. W., Chen, S. H., 2012. “Perception of earthquake risk in Taiwan: Effects of gender and past earthquake experience”. Risk Analysis 32, no. 9, p. 1535-1546.

Santos, C., Ferreira, T. M., Vicente, R., Mendes da Silva, J. A. 2013. “Building typologies identification to support risk mitigation at the urban scale–Case study of the old city centre of Seixal, Portugal”, Journal of Cultural Heritage 14, no. 6, p. 449-463.